

Evaluation of Artificial Sweeteners and Caffeine as Septic Effluent Markers in an Urbanizing Agricultural Watershed

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Septic systems discharge treated wastewater to ground water and therefore may contribute to nitrate contamination in domestic wells and surface water. However, septic systems are typically only one of many nitrate sources in rural areas, so locating and quantifying septic inputs requires chemical markers that are unique to septic effluent.

This study used artificial sweeteners and caffeine to help locate and evaluate septic effluent inputs in the Lindsay Creek watershed. The 22 square mile watershed has 72 percent agricultural land, increasing urban development, and elevated nitrate in both surface water and ground water. Approximately 800 parcels in the watershed (~15% of parcels) have an individual on-site septic system, but soil, fertilizers, livestock, and stormwater discharges are also potential nitrate sources.

Artificial sweeteners, which are unique to human wastes and are not completely removed by septic systems, were detected at 4 of 5 stream sites, in 4 of 5 domestic wells, and in 1 of 1 springs. Sweeteners were detected downstream of areas with high septic density, and not at unexpected locations. Caffeine was detected at two stream sites and one well. Because caffeine is typically completely removed by properly-functioning septic systems, caffeine detections indicate inputs from poorly-functioning septic systems at some locations. This conclusion is supported by local public health district records; caffeine was detected downstream of areas with a history of septic failures.

Results demonstrate artificial sweeteners and caffeine are useful indicators of septic effluent, and helped identify where septic effluent is present in the watershed. The relative contribution of septic effluent to nitrate contamination appears small, but is not fully clear because limited sweetener and caffeine concentration data from local septic systems are currently available.